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The effect of firm and stock characteristics on stock returns: Stock market crash analysis

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Abstract

This study aims to determine characteristics of stocks and firms that are deliberately affected by stock market crash occurring in Indonesia. The study uses data for three major stock market crashes that occurred in 1997, 2000, and 2008. The analysis is accomplished by using multivariate regression method. The results of the study find that stocks with higher betas, larger capitalization, more return volatility, higher debt ratios, lower levels of liquid assets, and lower asset profitability tend to lose more value on crash day. This study also finds that there are short-term and long-term momentum effects on stock returns during most of stock market crashes.

Keywords: Stock market; Crisis; Price reversal; Leverage; Herding behavior

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1. Introduction

Stock market is important in an economy because of its role in facilitating between surplus fund unit (investors) and deficit fund unit (stock issuers) to trade. Through the stock market, firms could meet their funding needs, so they are able to enhance their productivities and expand their businesses. For investors, investing in stock market could produce benefits both dividend and capital gain. Similar to other investments, putting investment into stock market carries certain risk taken from either idiosyncratic or market risks.[1] Risk encountered by investors is getting higher when financial market is exposed by crisis.[2] Financial crisis leads to decreasing price of stocks, which is possible to create capital loss for investors.

Recently, studies about factors causing crisis in a stock market become urgent. Patel and Sarkar[3] found that crisis in one country will be immediately followed by other countries in a regional, signaled by a typical stock price decline and crisis duration. Baig and Goldfajn[4] stated that one of causes in East Asia 1997 crisis is investor's panic (herding behavior). Wahyudi and Sani[2] found that there is a decline pattern on the stock market index and the Indonesia money market interest rate when a subprime mortgage crisis 2008 occurred in US. These various studies confirm that there is a contagion effect on stock markets between countries, which have close relation, either regional or economic activities.

There have been many studies, which examine factors of crisis, but only a few which analyze the impacts of crisis on stock performance. One of those studies is Miyajima and Yafeh[5] where they found that stocks which are affected the most by banking crisis in Japan are those with small capitalization, high leverage, low-tech, poor credit rating and low market-to-book-value ratio. Wang et al[1] also found that stock and firm characteristic can become the determinant of stock returns during eight major stock market crashes in US. Most of those studies still focus more developed markets, less on emerging market. However, according to Wahyudi and Sani[2]; emerging market, such as Indonesia, is potential to get the impact of global crises such as US subprime mortgage crisis 2008 and economic crisis in Europe 2011.

Referring to Wang et al[1]; this research observes the impact of stock market crashes in Indonesia on the performance of stocks, which have different characteristics. Specifically, this research examines three main points. The first point is to analyze the influence of stock-specific and company-specific characteristics on stock return during stock market crashes in Indonesia. The second is to identify certain characteristics of stocks, which will experience the deepest price decline during stock market crash. The last is to discover industry-related characteristics, which are mostly affected by stock market crashes. We use the model employed by Wang et al[1] along with the definition of stock market crash taken from Patel and Sarkar.[3] This research analyses crashes that happened in Indonesia stock market in 1997, 2000, and 2008, using all stocks from firms which were listed for at least five years prior to the crash date, excluding financial firms and state-own firms. Data used in this study is both daily and monthly price, transaction volume, and firms' year-end financial statements prior to the stock market crash date.

The rest of this paper will be arranged as follows. Section 2 is the literature review. Section 3 is the data and methodology. Section 4 is the results and analysis. Section 5 is the conclusions and managerial implications. Section 6 is the suggestions for further research.

2. Literature review

2.1. Integrated market theory

According to Engle and Granger[6]; integration is co-movement of some variables to reach a balance area in the long-term period. Integrated stock market is a situation where two or more different stock markets have a typical trend.[2]

Stock markets are said integrated when they have continuous balance relation. From these definitions, Choi and Rajan[7] divided stock market in three levels: full integrated market, mild segmentation, and full segmentation. Beckers, Connor and Curds[8] measured the level of integrated market by using three approaches: investment restriction for global investors (regulations, tax, and administrative factors), the consistency of stock prices between different stock markets, and the correlation of stock prices between different stock markets.

There are three factors that lead to establish integrated stock market. The first is globalization. Globalization, which exists due to interaction in non-financial market between countries, will also affect financial and capital markets. The second is a growing number of firms that sell their stocks in two or more different stock markets. The last factor is related to the efficiency theory of regional stock market where there is matching information between the prices of various financial assets from different stock markets.[9] Integrated regional market is more efficient than segmented national market.[10]

Theoretically, integrated stock market will be able to lower the cost of capital.[11] Integrated market will stimulate capital inflow (outflow) between stock markets, enhance international diversification,[9] and reduce systematic risk with risk sharing.[12] Lower risk encourages investors to decrease their hurdle risk to invest. Yet, in long-term period, the greater stock markets are integrated, the lower benefits could be gained by portfolio diversification,[13] especially the opportunity to avoid non-systematic risk of stocks.[10] The non-systematic risk could instead be avoided by diversifying stocks to different stock markets when stock markets are not integrated.[14]

2.2. *Contagion effect and financial crisis*

A contagion effect strongly relates to a financial crisis. According to Dornbusch et al[15]; the contagion effect happens when cross-market linkage between countries experiences a significant increase during or after the crisis. The contagion effect is measured based on certain percentage of asset prices in a country which moves to the same trend as another country when the crisis exists compared to normal condition (non-crisis).[16]

Conceptually, the cause of the contagion effect is divided into two: spillover effect and herding behavior.[17] Spillover effect is a spreading shock effect that usually happens across stock markets as a result of the correlation of real and financial economic activities between countries. Herding behavior is a phenomenon of irrational investors who tend to be panic and withdraw their money, not only from the country, which is experiencing a crisis, but also from the country that has nothing to do with a crisis.[18] The irrational behavior usually exists because of panic, lack of confidence from investors, and an increase of risk-aversion behavior.

Chancharoenchai and Dibooglu[19] found that during East Asia crisis in 1997, Indonesia experiences a contagion effect from Japan as regional stock market and US as global stock market. They found that East Asia crisis in 1997 is started from Thailand, and then spreads over other countries, including Indonesia, which specifically receive shock transmission from Taiwan [18,20] However, in short-term period, Indonesia is always potential to get a shock effect from Japan and China stock markets,[2,21] regarding to strong trade and investment relation between Indonesia and those two countries.

2.3. *Stock market crash*

Stock market crash is a sudden decline of stock returns that is undergone by majority stocks in a stock market, causing a significant decrease of investors' wealth.[1] Technically, Mishkin and White[22] defined the stock market crash as a 20% drop in a stock price index over a period (around a day to a year). With this method, Mishkin and White[22] find that there are 15 stock market crashes in United States from 1900 to 2000.

Patel and Sarkar[3] proposed another definition of a stock market crash. They identified the crash as a significant decrease of stock prices relative to the historical maximum price during observed period, such as one or two years. They divided a process of the stock market crisis into four stages: beginning of crisis, beginning of crash, date of trough, and recovery. To determine these four stages, they employed the CMAX ratio, which is a ratio of stock price index in time t to the maximum price during observed period before t. The beginning of crash occurs when the CMAX ratio is below threshold value. Threshold value is defined as two standard deviations below the average value of CMAX for developed countries and Asia, and one and a half standard deviations below the average value of CMAX for Latin America countries. This definition of stock market crash has been frequently used by stock market practitioners, such as MSCI Perspective Publication and BARRA Wall Street Review in Forbes Magazine, also followed

by several researches such as Villa 2000; Illing and Liu[23]; Das et al[24]; Coudert and Gex[25]; Zouaoui et al[26]; and Mukulu et al[27]

The impacts of stock market crashes on financial stability depend on the fundamental condition of a country. When the financial condition before a stock market crash exists is strong, stock market crash could not cause a serious distraction.[22] In the last two decades in Indonesia, it has been recognized that there are two severe crises: the financial crisis 1997 in East Asia and the subprime mortgage crisis 2008 in US. Even though the sources of crises are various, the impact of crises could be clearly seen in the macroeconomic indicators such as stock market performance, as being found by Wahyudi and Sani.[2]

3. Data and methodology

3.1. Data and variables

The data used to analyze variables consists of daily or monthly stock prices, daily trading volumes, and firms' year-end financial statement prior to the stock market crash date. The data is obtained from Thomson Reuters Database – DataStream.

Following Patel and Sarkar[3]; we identify stock market crash (date of trough) through several stages. The first, we calculate the CMAX ratio using daily stock price data from 4 April 1983 to 4 April 2014. The observed period (rolling window) used is one year.[28] The CMAX ratio is computed as follow:

$$CMAX_t = \frac{P_t}{\max(P_t, \ldots, P_{t-260})}$$

where max (P_t, …,P_{t-260}) is the maximum value of stock price index (P_t) in the last one year.

Then, we determine the beginning of crash, which is when CMAX ratio is below two standard deviations from historical average of CMAX.

$$CMAX_{crash} = CMAX_t < -2\sigma\overline{CMAX}$$

After defining the beginning of crash, we determine the beginning of crisis, which is when the CMAX ratio reach the maximum value (1) before the beginning of crash, and determine the date of recovery ($CMAX_{recovery}$), which is when the CMAX ratio reach the maximum value (1) after the beginning of crisis. Date of trough ($CMAX_{trough}$) or a stock market crash event is when CMAX ratio reaches the minimum value between the beginnings of crash period to date of recovery.

$$CMAX_{trough} = \min\left(CMAX_{crash}, \ldots, CMAX_{recovery}\right)$$

Fig. 1 shows that when market index (IHSG) always increases, CMAX ratio will constantly equal to one. Stock market crash happens when market index reaches the lowest point, after going across threshold value. The stages of stock market crash in Indonesia during period of 4 April 1983 to 4 April 2014 are showed on Table 1.

Samples used in this research are all private firms, which are listed on the Indonesia Stock Exchange (IDX), except utilities and financial firms. We exclude utilities, because both regulation and financial firms affect their financial decisions and their financial

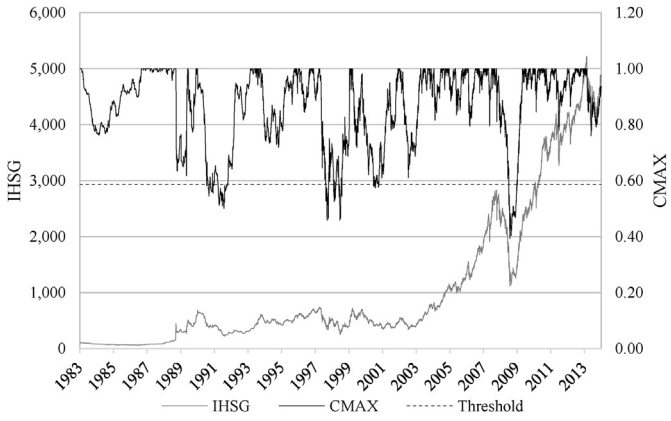

Fig. 1. Market Index (IHSG) and CMAX ratio in Indonesia Stock Exchange.

ratios are not comparable to those of industrial firms. These firms have been listed for at least five years prior to the crash date in order to analyze BETA. With these criteria, the total samples which are acquired for every period are not available (1991), 66 firms (1997), 108 firms (2000), and 194 firms (2008).

Dependent variables in this research are daily stock returns (one-day event window) when stock market crash occurred (date of trough), formulated by $RET_{i,t} = ([P_{i,t} - P_{i,t-1}]/P_{i,t-1})$. BETA is applied to measure systematic risk of a stock. This risk is measured based on the volatility of stock return toward market return. To avoid bias in non-synchronous trading, there are several ways to correct bias proposed by Blume[29]; Scholes and Williams[30]; Dimson[31]; and Fowler and Rourke.[32] We use bias correction method developed by Scholes and Williams[30]; which is based on single-index model. Scholes-Williams's BETA (1977) could be defined as:

$$BETA_{i,t} = \frac{b_{i,t}^{-} + b_{i,t} + b_{i,t}^{+}}{1 + 2\rho_{m,t}}$$

where $b_{i,t}^{-}$ for beta lag, $b_{i,t}$ for beta t, $b_{i,t}^{+}$ for beta lead, and $\rho_{m,t}$ for market autocorrelation.

By using monthly stock return for five years before stock market crash,[1] coefficient of $b_{i,t}^{-}$(beta lag) acquired by regression:

$$\begin{pmatrix} r_{i,t} \\ r_{i,t-1} \\ \vdots \\ r_{i,t-60} \end{pmatrix} = a_{i,t}^{-} \begin{pmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{pmatrix} + b_{i,t}^{-} \begin{pmatrix} r_{m,t-1} \\ r_{m,t-2} \\ \vdots \\ r_{m,t-61} \end{pmatrix} + \begin{pmatrix} e_{i,t}^{-} \\ e_{i,t-2}^{-} \\ \vdots \\ e_{t-60}^{-} \end{pmatrix}$$

Coefficient of $b_{i,t}$ (beta t) acquired by regression:

$$\begin{pmatrix} r_{i,t} \\ r_{i,t-1} \\ \vdots \\ r_{i,t-60} \end{pmatrix} = a_{i,t} \begin{pmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{pmatrix} + b_{i,t} \begin{pmatrix} r_{m,t} \\ r_{m,t-1} \\ \vdots \\ r_{m,t-60} \end{pmatrix} + \begin{pmatrix} e_{i,t} \\ e_{i,t-1} \\ \vdots \\ e_{i,t-60} \end{pmatrix}$$

Coefficient of $b_{i,t}^{+}$(beta lead) acquired by regression:

$$\begin{pmatrix} r_{i,t} \\ r_{i,t-1} \\ \vdots \\ r_{i,t-60} \end{pmatrix} = a_{i,t}^{+} \begin{pmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{pmatrix} + b_{i,t}^{+} \begin{pmatrix} r_{m,t+1} \\ r_{m,t} \\ \vdots \\ r_{m,t-59} \end{pmatrix} + \begin{pmatrix} e_{i,t}^{+} \\ e_{i,t-2}^{+} \\ \vdots \\ e_{t-60}^{+} \end{pmatrix}$$

Coefficient of $\rho_{m,t}$ (market autocorrelation) acquired by regression:

$$\begin{pmatrix} r_{i,t} \\ r_{i,t-1} \\ \vdots \\ r_{i,t-60} \end{pmatrix} = \rho_{m,t} \begin{pmatrix} r_{m,t-1} \\ r_{m,t-2} \\ \vdots \\ r_{m,t-61} \end{pmatrix} + \begin{pmatrix} e_{i,t}^{-} \\ e_{i,t-2}^{-} \\ \vdots \\ e_{t-60}^{-} \end{pmatrix}$$

Size of firms is measured by logarithm of firms' market capitalization (SIZE). Market value to book value (MVBV) is a ratio of firms' market capitalization to book value. One of proxies for stock liquidity is stock illiquidity.[33] Following Amihud[34]; ILLIQ (stock illiquidity) is calculated by:

$$ILLIQ_{i,t} = \frac{\sum_{t=1}^{T} \frac{|RET_{i,t}|}{Volume_{i,t}} * 10,000,000}{T}$$

where Volume is trading volume in Rupiah, and T is observed period over a year before stock market crash (t_{-252}, …,t_{-30}).

Stock return volatility (SDLR) is computed as standard deviation of lagged returns over one year before stock market crash ($r_{i,t-30}$, …,$r_{i,t-252}$).

Table 1
The process of stock market crashes in Indonesia.

Beginning of crisis	Beginning of crash	Date of trough	Date of recovery
04 April 1990	18 October 1990	28 October 1991	26 May 1993
08 July 1997	18 November 1997	15 December 1997	03 May 1999
21 June 1999	18 September 2000	30 October 2000	06 March 2002
11 January 2008	06 October 2008	28 October 2008	31 July 2009

To recognize momentum and reversal effects in a stock market crash, we use lagged return variable (LR) which is cumulative stock returns in a period (7 days = short term, 70 days = middle term, 756 days = long term), with formula LR1 = [$RET_{i,t-2}$-$RET_{i,t-7}$]/$RET_{i,t-7}$, LR2 = [$RET_{i,t-2}$-$RET_{i,t-70}$]/$RET_{i,t-70}$, dan LR3 = [$RET_{i,t-2}$-$RET_{i,t-756}$]/$RET_{i,t-756}$ respectively.

Firm's leverage is measured by TDTA, which is a ratio of total debt to total assets. Firm's level of liquidity is measured by liquid assets ratio (LAR), which is a ratio of cash and short-term investment to total assets. CFPS (cash flow per share) is computed as operating cash flow minus preferred dividends, and then divided by outstanding common shares. Firm profitability is measured using basic earning power (BEP), which is computed as a ratio of EBIT (earning before interest and tax) to total assets.

We also analyzes whether there will be any differences of crash effects across economic sectors. We use industry classification based on Jakarta Industrial Classification Sectoral Index (JASICA). There are 6 dummy variables: D1 (Trade and Service), D2 (Miscellaneous Industry), D3 (Basic Industry and Chemical), D4 (Consumer Goods), D5 (Property and Real estate), and D6 (Mining, Agriculture, Transportation and Infrastructure).

The descriptive statistic and the bivariate correlation from all variables are presented in Table 2. From Table 2, the most significant correlation (absolute) between explanatory variable is shown between MVBV and SIZE (2007) with coefficient of correlation at 0.632. According to Gujarati[35]; two or more independent variables have multicollinearity problem if absolute correlation between variables is 0.8 or above. Therefore, this research could be concluded that there is no multicollinearity problem between variables.

3.2. Model specification

To observe the determinant factors of stock returns during stock market crash, we use model as follow:

$$RET_{i,t} = \beta_0 + \beta_1 BETA_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 MVBV_{i,t} + \beta_4 ILLIQ_{i,t} + \beta_5 TDTA_{i,t} + \beta_6 LAR_{i,t} + \beta_7 CFPS_{i,t} + \beta_8 BEP_{i,t} + \beta_9 SDLR_{i,t} + \beta_{10} LR1_{i,t} + \beta_{11} LR2_{i,t} + \beta_{12} LR3_{i,t} + \beta_{13} D_i + \varepsilon_{i,t}$$

In above model, dummy variables for economic sectors used are chosen based on separated regression results, which is estimated before. From estimation result of parameter, it is found that dummy variable D6 for economic sector of Mining, Agriculture, Transportation and Infrastructure gives most significant result, which is in the significant level <1.00% in all stock market crash events.

To carry out industry-sector analysis closely, we use the second model. This model is appropriate to compare performance between economic sectors. The industry sector of D6 is represented by intercept model. The model is also applied for identifying variables between economic sectors, so it could be recognized any variables that could describe whole characteristics of related economic sectors.

$$RET_{i,t} = \beta_0 + \beta_1 BETA_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 MVBV_{i,t} + \beta_4 ILLIQ_{i,t} + \beta_5 TDTA_{i,t} + \beta_6 LAR_{i,t} + \beta_7 CFPS_{i,t} + \beta_8 BEP_{i,t} + \beta_9 SDLR_{i,t} + \beta_{10} LR1_{i,t} + \beta_{11} LR2_{i,t} + \beta_{12} LR3_{i,t} + \beta_{13} D1_i + \beta_{14} D2_i + \beta_{15} D3_i + \beta_{16} D4_i + \beta_{17} D5_i + \varepsilon_{i,t}$$

4. Results and analysis

4.1. Stock market crash events in Indonesia

Based on the duration of crash events (days to trough), stock market crash in Indonesia can be categorized into two types, which are slow crash and quick crash. Slow crashes occurred in 1991 and 2000, where the market index needs more than a year to reach the lowest value, which are 408 and 355 days respectively (Table 3). In contrast, the crashes in 1997 and 2008 can be categorized as quick crash, as seen from the price decline to minimum value which required less than a year (114 and 207 days respectively).

All crisis periods, except crisis in 1997, are started by significant increases of yearly market index average return, either one year or three years before the crises. This finding is also existing in Roll[36] where they find that nine months before the October 1987 crash in US, there is a substantial increase of assets' prices in several international stock markets. Three years before the crises in 1991 and 2008, average returns exceed the amount of price decrease during the crises. This shows that the typical crises in those years are bubble.[37] A bubble crisis is usually caused by bad banking credit policy.

A severe crisis occurred in Indonesia in 1997. In this period, there is a large and quick decrease of price index, which is at around 46.00% only in 144 days. Recovery time from crisis in 1997 is quite long, which lasts for 360 days,

Table 2
Descriptive statistics of variables.

	RET	BETA	SIZE	MVBV	ILLIQ	TDTA	LAR	CFPS	BEP	SDLR	LR1	LR2	LR3
a. Stock market crash in 15 December 1997[a]													
RET	1.000												
BETA	−0.473	1.000											
SIZE	−0.255	0.322	1.000										
MVBV	−0.053	0.038	0.632	1.000									
ILLIQ	0.166	−0.095	−0.467	−0.297	1.000								
TDTA	−0.067	0.082	0.074	−0.126	0.024	1.000							
LAR	−0.060	0.200	0.231	0.042	−0.300	0.141	1.000						
CFPS	0.069	−0.212	−0.112	−0.068	−0.015	−0.089	−0.052	1.000					
BEP	−0.091	−0.082	0.278	0.572	−0.276	−0.546	0.019	0.321	1.000				
SDLR	0.006	−0.132	−0.263	−0.209	0.219	−0.082	0.058	−0.028	−0.195	1.000			
LR1	0.248	−0.417	0.010	0.049	0.037	0.068	0.011	0.038	0.107	−0.086	1.000		
LR2	0.422	−0.761	−0.080	0.098	−0.011	−0.197	−0.006	0.195	0.231	−0.076	0.484	1.000	
LR3	0.144	−0.347	0.091	0.102	−0.024	−0.261	−0.127	0.156	0.395	−0.023	0.126	0.354	1.000
Mean	−0.045	0.783	26.100	1.533	0.010	0.389	0.123	0.203	0.092	0.041	−0.035	−0.336	−0.172
Median	0.000	0.856	26.211	0.895	0.004	0.410	0.084	0.063	0.087	0.036	0.000	−0.381	−0.389
Maximum	0.229	1.731	30.411	9.562	0.087	0.967	0.383	4.008	0.287	0.175	0.150	0.282	4.308
Minimum	−0.396	−0.412	22.313	−2.387	0.000	0.000	0.007	−0.323	−0.278	0.009	−0.375	−0.777	−0.932
Std. Dev.	0.102	0.461	1.898	1.852	0.016	0.191	0.102	0.578	0.081	0.022	0.100	0.264	0.771
b. Stock market crash in 30 October 2000[b]													
RET	1.000												
BETA	−0.250	1.000											
SIZE	−0.184	−0.091	1.000										
MVBV	−0.032	−0.032	0.233	1.000									
ILLIQ	0.166	0.097	−0.336	−0.025	1.000								
TDTA	−0.218	0.232	−0.218	−0.163	0.252	1.000							
LAR	0.037	−0.025	−0.018	0.121	−0.025	−0.106	1.000						
CFPS	0.133	−0.188	−0.132	0.021	−0.155	−0.287	0.028	1.000					
BEP	0.202	−0.129	−0.045	0.188	−0.077	−0.220	0.334	0.398	1.000				
SDLR	−0.111	0.090	−0.287	0.084	0.363	0.285	0.029	−0.247	−0.250	1.000			
LR1	0.198	−0.138	−0.079	−0.018	−0.161	−0.099	0.229	0.217	0.332	−0.256	1.000		
LR2	0.162	−0.142	−0.179	−0.199	−0.071	−0.091	0.049	0.127	0.196	−0.190	0.219	1.000	
LR3	−0.001	0.134	−0.193	0.045	−0.118	−0.222	0.017	0.152	0.400	0.060	0.180	0.190	1.000
Mean	−0.017	1.544	25.537	0.607	0.031	0.522	0.142	0.185	0.142	0.045	−0.041	−0.168	1.038
Median	0.000	1.402	25.195	0.476	0.010	0.536	0.105	0.047	0.119	0.038	−0.031	−0.195	0.115
Maximum	0.091	7.194	30.970	6.650	0.441	1.458	0.590	5.718	0.495	0.161	0.101	1.556	11.737
Minimum	−0.129	−1.580	22.158	−16.735	0.000	0.000	0.001	−3.646	−0.127	0.010	−0.225	−0.806	−0.917
Std. Dev.	0.030	1.129	1.897	2.121	0.054	0.343	0.125	0.930	0.116	0.021	0.060	0.237	2.467
c. Stock market crash in 28 October 2008[a]													
RET	1.000												
BETA	−0.257	1.000											
SIZE	−0.280	0.419	1.000										
MVBV	−0.073	0.111	0.435	1.000									
ILLIQ	0.080	−0.041	−0.362	−0.114	1.000								
TDTA	−0.025	−0.088	−0.150	−0.356	−0.066	1.000							
LAR	0.048	0.114	0.136	−0.023	−0.073	−0.045	1.000						
CFPS	−0.024	−0.033	0.177	0.086	−0.125	−0.144	0.159	1.000					
BEP	−0.035	0.147	0.352	0.445	−0.053	−0.586	−0.010	0.210	1.000				
SDLR	−0.048	0.282	−0.179	−0.111	0.580	−0.118	−0.107	−0.132	−0.076	1.000			
LR1	0.329	−0.574	−0.393	−0.098	0.140	0.110	−0.120	−0.020	−0.063	−0.174	1.000		
LR2	0.244	−0.803	−0.398	−0.068	0.053	0.037	−0.064	0.004	−0.082	−0.334	0.597	1.000	
LR3	0.109	−0.077	−0.137	−0.022	−0.028	0.018	0.015	−0.045	0.006	−0.023	0.164	0.239	1.000
Mean	−0.017	0.610	26.764	1.442	0.083	0.295	0.117	0.157	0.063	0.036	−0.072	−0.275	0.606
Median	0.000	0.578	26.529	0.984	0.009	0.249	0.065	0.016	0.065	0.034	−0.005	−0.247	0.070

(*continued on next page*)

Table 2 (*continued*)

	RET	BETA	SIZE	MVBV	ILLIQ	TDTA	LAR	CFPS	BEP	SDLR	LR1	LR2	LR3
Maximum	0.100	2.216	31.810	16.847	0.789	3.351	0.882	5.450	0.629	0.086	0.200	0.336	19.625
Minimum	−0.100	−0.321	22.940	−12.094	0.000	0.000	0.000	−1.089	−2.271	0.000	−0.378	−0.795	−0.944
Std. Dev.	0.041	0.500	2.052	2.524	0.159	0.367	0.139	0.604	0.218	0.017	0.107	0.271	1.985

[a] ILLIQ showed in bps unit. CFPS showed in thousand Rupiah.
[b] ILLIQ shown in 100-bps unit. CFPS shown in thousand Rupiah.

Table 3
Stock market crash characteristics in Indonesia.

Date of trough	Duration		Price decline to trough	Annual return before crisis		Annual return after crisis	
	Days to trough	Days to recovery		One year	Three years	One year	Three years
28/10/1991	408	412	50.00%	102.90%	129.30%	51.20%	25.20%
15/12/1997	114	360	46.00%	28.90%	23.20%	0.20%	5.10%
30/10/2000	355	352	57.00%	70.30%	17.70%	−18.00%	40.00%
28/10/2008	207	198	39.00%	68.70%	42.50%	32.10%	21.90%

Note: Days of trough is time needed to change from beginning of crash to date of trough, or the time required by stock price index to reach the lowest level. Days to recovery is time needed to change from date of trough to date of recovery, or the time required by stock price index to get back to the maximum level. Price decline to trough is the amount of price decline from beginning of crisis to when price index reach the lowest level.

with relatively small annual return during one and three years after crisis. Patel and Sarkar[3] say that crisis in 1997 is caused by high interest rate and bad banking credit policy.

There is a relation between crisis in 2000 and crisis in 2008. Crisis in 2008 is triggered by crisis in 2000. Crisis in 2000 is more caused by "dotcom bubble" phenomenon that happened in US. "Dotcom bubble" is a phenomenon of Internet industry development that grows incredibly quick and fast. Internet-based and internet-related firms are valued highly by investors, so the stock prices increase significantly in the short time. In Indonesia, the impact of it could be seen from index returns one year before crisis in 2000, which is relatively high at around 70.30%. However, this phenomenon only lasts for a while. The prices suddenly turn down when investors realize that they have over-valued the stocks. Eventually, in the last quarter in 2000, stocks of 'dotcom firms' (most of them are new firms) decreased sharply, so it causes a crash.

The impact of crash in 2000 led many firms in US to bankruptcy and default their debt. To overcome these problems, The Fed took a policy of lowering interest rate. Yet, in other side, property firms was utilized the low interest rate to fund housing. Houses were sold to low-income groups that had no appropriate collateral (subprime). This became the beginning of subprime mortgage crisis in 2008. The crisis reached the worst condition when Lehman Brothers, the biggest banker in US, was bankrupt in October 2008. Crisis happening in US then infected to several countries, and it became global crisis. The impacts inexcusably reach in Indonesia stock market.[2]

4.2. Beta and systematic risk

Table 4 shows that F-statistic and adjusted R-squared is statistically significant at the 1.00% level in all crash events, so it could be concluded that the model is fit and all independent variables can describe significantly the variability of stock returns (RET). Consecutively, adjusted R-squared for crisis in 1997 is at 97.75% (Model 1), 87.32% (Model 2) and 76.68% (Model 3) while crisis in 2000 is at 96.33% (Model 1), 96.09% (Model 2) and 98.95% (Model 3). Then, crisis in 2008 is at 95.76% (Model 1), 97.60% (Model 2) and 96.36% (Model 3). Table 4 shows that most of independent variables significantly influence stock returns during stock market crash, except MVBV (2008), ILLIQ (1997 and 2008), CFPS (2008), BEP (2008), LR1 (1997), and LR2 (1997 and 2000).

BETA is statistically significant at the level 1.00% in all crashes with negative sign. It means that stocks with higher BETA experience a greater loss in stock market crashes. Higher BETA indicates higher systematic risk that will be faced by investors. So, based on risk-aversion behavior, investors tend to avoid those stocks during crash events. This finding is in line with classic theory of capital asset pricing model (CAPM)[38,39] which stated that there is a positive relation between beta as a proxy of risk and returns. This finding also supports a theory of 'conditional relationship'

Table 4
Regression result.

Explanatory Variable	Market crash 1997			Market crash 2000			Market crash 2008		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	0.379 (0.112)***	0.373 (0.103)***	0.393 (0.156)**	0.084 (0.005)***	0.092 (0.006)***	0.107 (0.012)***	0.095 (0.007)***	0.103 (0.003)***	0.102 (0.009)***
BETA	−0.069 (0.018)***	−0.079 (0.017)***	−0.101 (0.028)***	−0.004 (0.001)***	−0.004 (0.001)***	−0.003 (0.001)***	−0.009 (0.001)***	−0.008 (0.001)***	−0.004 (0.001)***
SIZE	−0.011 (0.004)***	−0.011 (0.003)***	−0.008 (0.006)	−0.0053 (0.000)***	−0.003 (0.000)***	−0.003 (0.000)***	−0.004 (0.000)***	−0.004 (0.000)***	−0.004 (0.000)***
MVBV	0.016 (0.005)***	0.014 (0.004)***	0.013 (0.006)*	−0.001 (0.000)***	0.000 (0.000)*	−0.001 (0.000)***	0.001 (0.000)**	0.000 (0.000)	0.000 (0.000)
ILLIQ	0.905 (0.340)***	0.311 (0.517)	0.496 (0.514)	0.146 (0.016)***	0.149 (0.018)***	0.116 (0.025)***	0.001 (0.002)	0.005 (0.002)**	0.005 (0.004)
TDTA	−1.127 (0.041)***	−0.088 (0.038)**	−0.085 (0.045)*	−0.024 (0.001)***	−0.022 (0.001)***	−0.022 (0.001)***	−0.005 (0.001)***	−0.006 (0.001)***	−0.007 (0.002)***
LAR	0.169 (0.050)***	0.169 (0.047)***	0.178 (0.061)***	−0.021 (0.004)***	−0.025 (0.004)***	−0.024 (0.006)***	0.026 (0.004)***	0.022 (0.003)***	0.022 (0.004)***
CFPS	0.014 (0.004)***	0.012 (0.004)***	0.019 (0.007)***	−0.002 (0.000)***	−0.002 (0.000)***	−0.003 (0.000)***	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)
BEP	−0.537 (0.144)***	−0.453 (0.140)***	−0.573 (0.171)***	0.041 (0.006)***	0.047 (0.006)***	0.040 (0.006)***	0.003 (0.002)	0.006 (0.002)***	0.003 (0.003)
SDLR	−0.972 (0.172)***	−1.027 (0.170)***	−1.108 (0.483)**	−0.116 (0.030)***	−0.138 (0.030)***	−0.128 (0.036)***	−0.050 (0.021)**	−0.097 (0.025)***	−0.134 (0.021)***
LR1	0.084 (0.059)	0.078 (0.057)	0.048 (0.085)	0.086 (0.009)***	0.091 (0.008)***	0.090 (0.013)***	0.099 (0.009)***	0.099 (0.007)***	0.095 (0.011)***
LR2	0.026 (0.033)	0.008 (0.032)	0.004 (0.038)	0.005 (0.002)**	0.004 (0.002)	0.005 (0.003)	−0.011 (0.002)***	−0.007 (0.002)***	−0.007 (0.003)**
LR3	0.011 (0.005)**	0.010 (0.005)**	0.011 (0.009)	−0.002 (0.000)***	−0.002 (0.000)***	−0.002 (0.000)***	0.001 (0.000)***	0.001 (0.000)***	0.001 (0.000)***
D1	n.a.	n.a.	−0.031 (0.017)*	n.a.	n.a.	−0.015 (0.002)***	n.a.	n.a.	−0.010 (0.002)***
D2	n.a.	n.a.	−0.091 (0.022)***	n.a.	n.a.	−0.012 (0.001)***	n.a.	n.a.	−0.005 (0.002)***
D3	n.a.	n.a.	−0.037 (0.026)	n.a.	n.a.	−0.013 (0.002)***	n.a.	n.a.	−0.017 (0.002)***
D4	n.a.	n.a.	−0.054 (0.017)***	n.a.	n.a.	−0.015 (0.002)***	n.a.	n.a.	−0.009 (0.002)***
D5	n.a.	n.a.	−0.067 (0.024)***	n.a.	n.a.	−0.018 (0.005)***	n.a.	n.a.	−0.011 (0.002)***
D6	n.a.	0.062 (0.012)***	n.a.	n.a.	0.015 (0.002)***	n.a.	n.a.	0.014 (0.002)***	n.a.
Observation	66	66	66	108	108	108	194	194	194
Adj. R^2	0.978	0.873	0.767	0.963	0.961	0.990	0.958	0.976	0.964
F statistic	235.93***	35.43***	13.57***	235.10***	203.43***	594.17***	364.44***	605.10***	301.30***

between beta and return that revealed by Pettengill et al[40]; Fletcher[41]; and Elsas, El-Shaer and Theissen.[42] The theory proposes that when market-risk premium is positive, a relation between beta and returns is also positive. Conversely, when market-risk premium is negative (exist during stock market crash), relation between beta and return is also negative.

4.3. Stock idiosyncratic factors

Stock idiosyncratic variables are represented by SIZE, MVBV, ILLIQ and SDLR. Empirically, Xu and Malkiel[43] find that idiosyncratic risk positively related with stock returns, and because of that, it can be used as the determinant of returns when the crash occurred, along with market risk factor.

SIZE is significant at the level of 1.00% with negative sign in all crashes. It means that large firms tend to suffer more losses during stock market crash. According to Lo and MacKinlay[44]; v Richardson and Peterson[45]; large firms consistently earn higher returns because they can respond information faster. Thus, during the crash events, large firms respond negative information faster, so they lose more value compared to small firms. The theory of 'information response' is supported by Wang et al[1] that also found that large firms are quick to recover by giving higher returns compared to small firms in three days after crash.

MVBV is significant in 1997 and 2000 crashes only at the level of 10.00% with positive sign, and it is not significant in 2008 crash. This finding shows that MVBV is not as important as two other variables of three-factor CAPM, which are BETA and SIZE. Wang et al[1] also found that MVBV cannot be the determinant of stock returns in majority crash events in US. The positive coefficient of MVBV in 1997 and 2000 crash events shows that stocks with low MVBV experience a greater loss. This finding follows the theory of three-factor CAPM, Fama and French[38] and[39]; which stated that stocks with low MVBV have higher risk. Miyajima and Yafeh[5] also identified that firms with low MVBV suffer more during the banking crisis in Japan.

ILLIQ is significant during 2000 crash at the level of 1.00%, but not significant during 1997 and 2008 crashes. In all crashes, ILLIQ has a positive sign, which means stocks with low ILLIQ (high liquidity) lose more value. This result contradicts with the theory of 'flight to quality and liquidity'. The flight-to-quality theory states that during uncertain period, investors tend to move their assets from risky assets to safe ones, whereas the flight-to-liquidity theory is when investors would rather invest in liquid assets than illiquid ones. These phenomenons often coexist, as safe assets tend to be more liquid. The theory is supported by Amihud et al[46] who found a negative relation between illiquidity and stock returns during 1987 crash in US. We argue that the difference of the result in this study is relatively caused by the difference of periods taken to do observation. Amihud et al[46] used several-day observation while this study, following Wang et al[1]; uses one-day event window, so the price decrease for stocks with high liquidity appears more obvious.

SDLR is significant at the level of 1% with negative sign during crash events in 1997 and 2008. This shows that stocks that have higher return volatility tend to experience a greater loss during stock market crash. It is because higher volatility of stock returns carries relatively higher risk. Our finding is in line with Wang et al[1]

4.4. Momentum and reversal effects

Table 4 shows that LR1 has a positive coefficient in the significant level of 1.00% during 2000 and 2008 crashes. This presents that there is a short-term momentum effect (one week) before stock market crash. Winner (loser) stocks during a week before crash will continue to perform well (poorly) in stock market crash.[1,47]

Momentum and reversal effects are related to market reactions in order to dealing with new information. Momentum effects exist due to under-reaction of market, whereas reversal effects exist due to overreaction of market.[48] Characteristically, stock market crashes in Indonesia are classified into two types, which are slow crash (1991 and 2000) and quick crash (1997 and 2008). The difference of crash characteristics explains the difference of coefficient sign between LR2 and LR3 in every crash event.

A crash in 2008, LR2 has a negative coefficient, which means that there was a middle-term reversal effect (three months) in that crash. The reversal effect describes investors' overreaction to face a crash in 2008 that happens quickly. Surprisingly, LR3 has a positive coefficient in 1997 and 2008 crashes. This shows that in these crashes that happen quickly, there are long-term momentum effects (three years).

A crash in 2000, LR2 has a positive coefficient, which means that there is a middle-term momentum effect in that crash. The momentum effect explains that there is no overreaction of market because the crash is going slowly. LR3

surprisingly has a negative coefficient. This shows that in typically slow crash, there is a long-term reversal effect. So, it can be concluded that in a crash that happens quickly, there is a middle-term reversal effect and a long-term momentum effect. In contrast, a crash that happens slowly will possibly cause a middle-term momentum effect and a long-term reversal effect.

4.5. Firm-specific factors

In this study, we examine the effect of firm-specific factors on stock return when occur stock market crash, which is represented by TDTA, LAR, CFPS and BEP. Table 4 shows that TDTA is significant at the level of 10.00% in all stock market crashes. This shows that firms' stock with higher leverage experienced greater losses. High leverage indicates inability of firms to make interest and loan payments, which may lead to bankruptcy. In stock market crash events, the bankruptcy risk are paid more attention and avoided by investors, so the amount of stock price decline experienced by firms, which have high leverage, is considerable. This finding is similar to Miyajima and Yafeh[5] and Wang et al[1]

LAR is significant at the level of 1.00% in all stock market crashes. Intuitively, LAR will have positive sign because a high liquid asset is likely to have lower bankruptcy risk.[49] This study also finds the typical result in 1997 and 2008 crash events that LAR has positive signs. It means that stocks of firms, which have lower level of liquidity, experience greater losses. This is because firms, which have low liquidity, carry high bankruptcy risk. Yet, in 2000-crash event, LAR has a negative sign that means that firms with higher level of liquidity experienced a greater loss. This result is also founded by Wang et al[1] in most of crash events that happen in US. This relation could be further explained by 'excess fund hypothesis' that causes agency problem. According to Jensen[50] and Gadarowski et al[51]; high liquidity is seen as a bad signal by investors because it presents lack capability of firm managements to optimize their assets in order to earn profit in long-term period. Furthermore, Hillegeist et al[52] and Acharya, Davydenko and Strebulaev[53] stated that firms with high level of liquidity would face bankruptcy risk in long-term period.

CFPS is significant at the level of 1.00% in 1997 and 2000 crashes. Our finding is in line with Carpenter and Guariglia[54]; and Wang et al[1] Yet, the result of this study shows that CFPS has a different coefficient sign for each crash. In 1997 crash, CFPS has a positive sign; and the sign is negative in 2000 crash.

BEP is significant at the level of 1% during crash events in 2000 and 2008 with positive sign. It means that firms with lower level of profitability tend to have greater losses during crash events. Profitability is a proxy of bankruptcy risk. A higher firms' profitability makes its bankruptcy risk becoming lower.[49]

4.6. Stock market crashes on cross-industry sectors

Table 4 shows industry sectors such as trade, service and investment (D1), miscellaneous industry (D2), chemical and basic industry (D3), consumer goods (D4), and property and real estate (D5) have poor performance in all crash events, indicated by negative signs. However, industry sector such as mining, agriculture, transportation, and infrastructure (D6) has positive performance in all periods of crash events. Industry sectors that perform the worst in crash events in 1997, 2000 and 2008 are miscellaneous industry (D2), property and real estate (D5), and chemical and basic industry (D3) respectively. It can be seen from the coefficient of variable for industry sectors that have the smallest value.

5. Conclusion and managerial implication

There is a significant effect of stock and firm characteristics on stock returns during stock market crash in Indonesia in 1997, 2000, and 2008. As idiosyncratic factors, market value (MVBV) and stock illiquidity (ILLIQ) are inappropriate to be the determinant of stock returns during stock market crashes. This is described by an insignificant coefficient of these two variables in most of crash events. Also, a variable of middle term lagged returns (LR2) and firm cash flow per share (CFPS) could not consistently explain stock price decline during stock market crashes.

Stocks with higher level of market risk (BETA), larger market capitalization (SIZE), more return volatility one year prior to crash event (SDLR) lose more value during stock market crash. Stocks of firms with higher leverage (TDTA), lower liquidity (LAR) and lower profitability (BEP) also tend to lose more value during crash events. There are short-term (one week, LR1) and long-term (three years, LR3) momentum effects on stock returns during crash events.

When the probability of stock market crash increases in emerging market such as Indonesia, investors would better avoid stocks with characteristics: high systematic risk, big market capitalization, high return volatility, and stocks of firms with high leverage, low liquidity and low profitability. To avoid capital loss, investors could also consider creating stock portfolio composition mainly with stocks that have short-term (one week) and long-term (three years) cumulative returns positively, because it is expected that they will have momentum effect during stock market crash. Firms should consider evaluating financial policy strategies, such as decreasing the level of leverage, increasing the liquidity, and increasing the profitability of the firm. In the perspective of investors', those policies could reduce bankruptcy risk, so if stock market-crash occurs, the firms' stock will not experience a greater loss. For industry sectors, sector consists of mine, agriculture, transportation and infrastructure (D6) has good performance on stock market crash. Thus, industry sectors, which get the most severe impacts, are miscellaneous industry (D2) in 1997, property and real estate (D5) in 2000, and trade, service and investment (D3) in 2008.

6. Suggestion for further research

This study has several limitations. The suggestions for further study are adding more analysis on stock market crash in 1991, changing dependent variable to be ratio of return which is a comparison of price in the beginning of crash and price in the date of trough (which means taking longer observation), comparing beta bias correction method such as method of Blume[29]; Dimson[31] and Fowler and Rourke[32]; using current-ratio variable as a proxy of firm liquidity, and using different indicator of stock market crash as proposed by Wang et al[1] or Le Bris.[55]

Disclosure of potential conflicts of interest

The authors declare that they have no conflict of interest.

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